Research Paper | Botany | E-ISSN No : 2454-9916 | Volume : 3 | Issue : 6 | June 2017

SURVEILLANCE AND QUANTIFICATION OF SYNTHETIC FOOD COLOURANTS IN SELECTED CONFECTIONARY PRODUCTS IN CHENNAI

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ABSTRACT

The present study was conducted to survey various confectionary items for the presence of synthetic colourants and also to analyze the selected products quantitatively using uv –visible spectrophotometer. Out of 219 products observed 65.5% of biscuits ,71.4 % of chocolates,87.5% of cakes ,71% of sweets and 66.6% of juices were found to contain added synthetic colourants .over 24 produts were further categorized as biscuits,chocolates ,icecreams and juices and analyzed quantitatively to check their concentration,91.6% of products showed the presence of excess amount of synthetic colourants in their formulations . The concentrations of each product under study is depicted both in ppm and as mg/mL .The concentration of synthetic colourants in 8.% of the products was less than 100mg/mL or (100000ppm)and the same percentage is observed for the samples in the range of 200- 300 mg/mL ,while 33% of the items was found in the range of 300-600 mg/mLor 300000 – 600000ppm),In 50 % of the confectionaries concentrations exceeded 700mg/mL.

KEY WORDS: synthetic food colourants, Quantification, uv-visible spectro photo meter, Confectionaries, Survey, Chennai.

INTRODUCTION:

Colours by nature have an attractive potential wherever it is present. to impart an artificial freshness and to tempt the buyers, food products are given a colour identity besides the taste ,the flavours are correlated with the synthetic food colourants, viz orange flavoured products are usually given a combination of tartrazine and sunsetyellow which in market is usually called kesar colour. similarly strawberry and pista flavoured confectionaries are identified with pink and green colour which in turn are synthetic formulations .

In the middle of the nineteenth century, different kinds of synthetic colours were developed,which were considered as reliable and economical method s for partly restoring the original shade of the foods which would otherwise be less bright, these colourants are competitive substitutes to the natural colourants which are more expensive ,less stable and have less tinctorial power. (Achaya, 1984; Rao, (1990).countries around the world permits a variety of synthetic food colours . The USA permits seven, including Fast red (which is banned for use in India), Iran and Australia, thirteen each and in the European Union (EU) sixteen synthetic food colours are permitted. Each country is attempting to review these controls by strict surveillance .India permits addition of eight colours, viz. erythrosine, carmoisine, ponceau 4R, tartrazine, sunset yellow, brilliant blue FCF,Fast green FCF and indigo carmine for specified food items. In India, the Prevention of Food Adulteration (PFA) Act, which lays down specifications on the addition of additives to foods, was amended in 1995

(Prevention of Food Adulteration Act, 1995) and permitted the use of the synthetic food colours given in TABLE (1)

Table 1: Permitted synthetic food colours can be used in the following foods as per the PFA Act

Food items

1. Ice-cream, milk lollies, frozen dessert, flavoured milk, yoghurt, ice- cream mix powder
2. Non-alcoholic carbonated and non-carbonated ready-to-serve synthetic beverages including syrups, sherbets, fruit bar, fruit beverages, fruit drinks, synthetic soft drink concentrates.
3. Biscuits, including biscuit wafer, pastries, cakes, confectionery, thread candies, sweets, savouries (dal moth, mongia, phul gulab, sago papad, dal biji)
4. Peas, strawberries and cherries in hermatically sealed containers, preserved or processed papaya, canned tomato juice, fruit syrup, fruit squash, fruit cordial, jellies, jam, marmalade, candied crystallised or glazed fruits

Permitted colours usage has evoked concern because they are being used in excess of the statutory limit (100 ppm) or in foods in which they are not permitted.(Bhat and Mathur, 1998; Pratima and Bhat, 2003; Pratima et al., 2004, 2005; Padmaja et al., 2004.) The admissible daily intake ADI for permitted colours varies from 0.1 mg kg−1 body weight for erythrosine to 25 mg kg−1 body weight for fast green FCF. The more toxic the food colour, the lower is the ADI and Total daily intake of all food colours should be monitored since the ADI level of any food colours should not be exceeded . WHO, (1991) .These colourants are proven to cause a range of diseases in sensitive humans and there are to show evidences that these colourants are capable of bringing allergic symptoms in children. Many synthetic colorants are potentially toxic, the usage of colourants is strictly limited . As a result, accurate and reliable methods for the determination of synthetic food colorants are required for the assurance of food safety Qingchuan Chena,et al, (1998) Hence the present study has been conducted to survey the variety of confectionaries with added synthetic food colourants.

MATERIALS AND METHODS:

Over 219 confectionaries were used for analysis .They are classified as chocolates ,biscuits, ice-creams and drinks .They are again categorised according to the three different available synthetic food colourants namely apple green ,kesar orange and strawberry pink . The products having these colourants were processed further to remove the colour alone and the corresponding OD was read. Over 24 samples containing the above mentioned synthetic colurants were again differentiated as popular brand (PB) and less popular brand (LPB) to be subjected to extraction of colourants and quantification.

Method for Colour Extraction:

Synthetic dyes were separated according to method prescribed by Woodman, (1941) For liquid foods, samples were processed directly, but solid and semi-solid foods like biscuits, chocolates, ice-creams were dissolved in water before isolation of colours. About 25-50 mg of sample or its solution was taken in the beaker, few drops of glacial acetic acid and white animal wool was added and the contents of the beaker were boiled for a few minutes. The wool absorbed any synthetic dye if present. The wool was removed from the beaker, washed under running tap water and finally with distilled water. The colour from the dyed wool was recovered by boiling in dilute ammonium hydroxide solution. The wool was discarded and the colour solution was evaporated on water bath, After the removal of ammonia solution the colour was dissolved in a 2-3 ml of distilled water and evaporated again on the water bath. The dry colour then obtained was dissolved in few drops of water and stored in a stoppered glass bottle for further analysis.

Quantification of Extracted Dyes:

The extracted colours were quantified by reading the optical density (OD) of each coloured solution of the samples at specific wavelength and compared with that of the standard synthetic colurants.

RESULTS:

The confectionaries available in the markets were mostly found to contain added synthetic food colourants and other preservatives .with respect to the biscuits samples,65.5%of them were coloured in chocolates ,cakes, sweets and juices the coloured varieties were found in the following respective percentage as 71.4,87.5,71 and 66.6. (Table 2). The quantification of selected synthetic colourants like apple green, kesar orange and strawberry pink in the samples is compared against their standard graph ,(Graph 1). It showed that only 8% of them were found to contain less than 100 mg/mL of synthetic colourants.while the same percentage of samples were found to contain synthetic colourants in

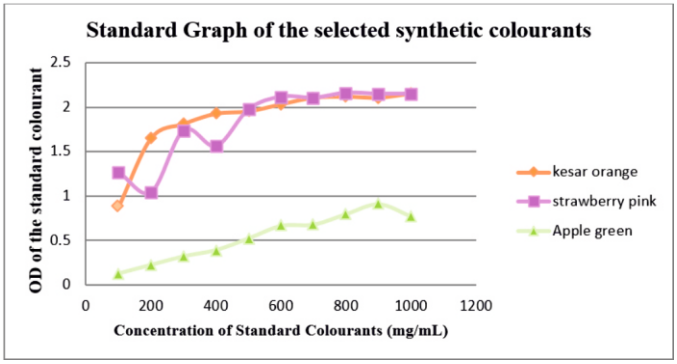
the range of 200-300 mg/mL , 33 %of the samples contain synthetic colourants in the range of 300-600 mg/mL, whereas 50% of the confectionaries have colourants in an excess concentrations of over 700mg/mL. In all the samples examined for the synthetic colourants Less popular brands (LPB) were found to contain more colour which exceeds permissible limit except for kesar orange present in biscuits .For all three colourants ,the drinks of popular brand (PB) and less popular brand (LBP) were found to show the maximum absorbance thereby proving the presence of excess range of these colourants as 700- 1000 mg/ml and the minimum absorbance is found with chocolate samples coloured with apple green in the range of 100-200 mg/mL Table (3).

Table 2: Showing coloured and non coloured samples

S.No	Samples	Number of samples	Number of coloured samples	Number of non-coloured samples
1.	Biscuits	29	19	10
2.	Chocolates	35	25	10
3.	Cakes	40	35	5
4.	Sweets	35	25	10
5.	Juices	30	20	10

Table 3: OD of the standard colorants and OD of the sample colorants

S.No	Concentration of the Std. colourants (mg/mL)	OD of the Std. colourant (1)	OD of the Std colourant (2)	OD of the Std colourant (3)	Samples	OD of the sample colorant (1)		OD of the sample colorant (2)	OD of the sample colorant (3)
1	100	0.879	1.265	0.125	Biscuits	PB	2.026	1.813	1.681
2	200	1.651	1.042	0.223		LPB	2.008	2.068	1.446
3	300	1.813	1.738	0.320	Chocolates	PB	1.042	1.244	0.134
4	400	1.928	1.559	0.391		LPB	2.017	2.017	0.134
5	500	1.954	1.974	0.523	Drinks	PB	2.434	2.136	2.055
6	600	2.034	2.115	0.665		LPB	2.035	2.138	2.055
7	700	2.107	2.103	0.679	Ice creams	PB	2.122	1.144	1.191
8	800	2.119	2.159	0.798		LPB	2.126	2.112	1.816
9	900	2.108	2.147	0.910					
10	1000	2.155	2.149	0.770					



Graph 1 : Standard graph of selected synthetic colourants

Food consumption patterns have transformed across the world .This is due to change in lifestyle and consumer preference to choose prepackaged and other ready to eat foods , Sridevi & Reddy (1998) . Along with globilisation ,there is a transformation observed among consumers towards their food choice especially the confectionary goods are made available in more attractive format by imparting added synthetic colours and added artificial flavours .Inorder to enhance the marketability ,the manufacturers of organised and unorganised sector despite maintaining the quality, is found to be lathergic in monitoring the limit of synthetic colourant usage. The survey was designed to check whether the selected synthetic colours are in permissible limit. There are many reports to substantiate the improper usage of synthetic colourants both qualitatively and quanditatively. Pratima rao and R V Sudersen.,(2005), reported the usage of synthetic colourants above permissible limit in sweet meats and sherbets in a study conducted at Hyderabad, India . The maximum permissible level of all food colours that can be added either individually or in blend form to diverent food is 100 ppm , (PFA 1993). This survey reports 73% of the confectionaries are coloured in which drinks of popular brand (PB) and less popular brand (LPB) showed the maximum range of 700- 1000 mg/mL . Concentrations of synthetic colourants were found to be present in excess limit in all selected confectionary products. Only 8 % of the selected confectionary is found to contain less than 100 mg/mL of synthetic colourants . Padmaja R et al ., (2004) showed that synthetic colourants in 73% of RTE (Ready To Eat) foods exceeded 100ppm and 27% were within the prescribed levels as prescribed by the Prevention of Food Adulteration Act of India, The maximum concentration of colours was detected in sweet meats > non-alcoholic beverage> miscellaneous foods > hard-boiled sugar confectioneries . But in our survey the maximum concentration of colours was observed with non-alcoholic drinks > biscuits >ice creams > chocolates. Meenakshi tripathi et al (2007)., reported the usage pattern of synthetic colours, 27% and 50% of the samples exceeded the maximum permissible limit of 100ppm in urban and rural areas respectively. This report shows 92 % of selected confectionaries exceeds permissible limit . Tartrazine (E102), Sunset Yellow FCF (E110), Brilliant Blue FCF (E 133) and Carmoisine (E122) are the four main incredients in the synthetic colourants of our study. These colourants are capable of causing a variety of toxic effects hyperactivity induction in children , creating hives, red skin rashes and may cause anaphylaxis, metabolic and idiosyncrasy reactions or affect blood pressure, mitochondrial respiration ,liver, kidneys and vitamins level, Soltandalal M et al & Pourahmad J (2011) .With increasing concentrations of Sunset Yellow and Brilliant Blue, Decreased Mitotic index frequencies and replication index values and increased micronucleus frequency was detected by Esra Kus and Halil Erhan Eroglu (2015). These four colourants affect and alter bioelements levels in vital organs e.g. liver, kidney and brain, Mustafa Cemek et al (2014). The effect of tartrazine in male albino mice showed decreased weight of testes and cauda ,which were found to be significant when compared with the respective control. There was a significant decrease in the sperm motility and density in a dose dependent manner.,Dolly Gautam et al (2010). T he main purpose of using this synthetic colourants are low costs, availability and lack of knowledge of adverse effects . Absence of the technical officer in the production unit and having no license or health code, the confectionary sectors are using the artificial colorings, beyond the permitted level. Such production units are only allowed to use natural and herbal colourings, Soltandalal M et al ., & Ashfaq N et al (2002). Introducing natural colorings to the public and emphasizing their advantages can guarantee the health of society and increase producer enthusiasm to use organic colorants, Yalda Arast et al (2013). For instance, replacing artificial red coloring with barberry fruit anthocyanins and yellow with Saffron is quite natural and are proven to have therapeutic properties. Pratima Rao and R.V. Sudershan has reported the medicinal properties of saffron . Hence arbitrarily fixing the limit at 100 ppm, to the permitted colours in all foods by the PFA is not justified. Each dye should have individual limit based on well controlled genetic studies. V. R. Swaroop et al (2011). This study is designed to check whether the synthetic colourants used in the selected confectionaries are present in permissible limit the results highlights that more than half of the products have excess amount of synthetic colourants which are considered to be very harmful to health hence its high time to switch over natural food colourants which would only help to promote organic food products in near future.

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